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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR		ATTORNEY DOCKET NO.
09/214,822	01/11/99	MULLER	S	14XZ00014

LM31/0413

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EXAMINER	
MILLER,M	
ART UNIT	**PAPER NUMBER**
2723	7

DATE MAILED: 04/13/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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Office Action Summary	Application No. 09/214,822	Applicant(s) Muller et al.
	Examiner Martin Miller	Group Art Unit 2723

☒ Responsive to communication(s) filed on pre-amt filed 8-25-99.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) *1-21* is/are pending in the application.

Of the above, claim(s) ______ is/are withdrawn from consideration.

☐ Claim(s) ______ is/are allowed.

☒ Claim(s) *1-21* is/are rejected.

☐ Claim(s) ______ is/are objected to.

☐ Claims ______ are subject to restriction or election requirement.

Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on ______ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on ______ is ☐ approved ☐ disapproved.

☒ The specification is objected to by the Examiner.

☒ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) ______.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______.

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *6*

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Information Disclosure Statement

1. The IDS provided has been reviewed by the Examiner and an initialed copy has been provided with this office action.

Oath/Declaration

2. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP § 602.

The oath or declaration is defective because:

the inventors have not signed the oath pursuant to 28 U.S.C. § 1748.

Drawings

3. The Drawings are objected to for the reasons cited on the PTO-948 by the Draftsman.

Specification

4. The Specification is objected to because of minor informalities such as on page 4, line 33 "invention is proposes" is improper grammar, and page 5, line 11, there is a repeated comma after the word "criterion".

5. Claim 1 is objected to because of the following informalities: line 23, there is an inadvertent colon after the word "and". Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As per claim 1, in step c does applicant mean to include extracting a second region of interest from a second image to which the first image region of interest is matched? Pages 3, ll. 20-25, and 5, l. 4 of the specification seem to indicate that is the intent of the invention. Clarification would be appreciated and such language added to the claim.

8. Claim 18 recites the limitation "product of the respective ranks" in line 8 of the claim. There is insufficient antecedent basis for this limitation in the claim. The applicant never explains how the product is taken nor if product is the end result of the ordering by probability or what the product is respective.

Claim 18 also is deficient grammatically with respect to the language "the region of homologous to..." (line 8 of the claim). Correction is required.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1 6, 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nields, US 5776062. This rejection may be overcome if Applicant provides an English translation of his priority document because Nields filing date is after Applicant's claimed foreign priority date.

As per claim 1, Nields teaches:

providing a set of digitized stereotaxic images having positions of homologous regions of interest corresponding to the element of interest and appearing in the set of stereotaxic images (col. 2, ll. 20, 55-60, col. 4, ll. 34-40);

selecting in a first stereotaxic image a first target region of interest having a target pixel (col. 7, ll. 30-55);

matching the first region of interest with a second region of interest homologous to the first region of interest and appearing in the second region of interest (col. 7, ll. 30-55);

•

matching a generated target window of chosen dimensional characteristics and containing the target region of interest around the selected target pixels (col. 7, ll. 46-55);

determining a set pixels in the second image according to a predetermined selection criterion so as to generate a second window having the same dimensional characteristics as the target window around each selected pixel (col. 8, ll. 15-20);

processing a correlation between the gray-scale levels of the pixels in each second window to obtain a correlation for each second window (col 8, ll. 13-38); Nields does not specifically state a gray-scale image, however, he provides that digital imaging is performed by a CCD sensor (col. 5, ll. 49-50). Therefore, it would have been obvious to one of ordinary skill that the CCD is capable of sensing gray-scale images.

using the correlation values to identify the region of interest homologous to the target region of interest (col. 4, ll. 30-35) and thereby minimize the risk of matching error between the homologous regions of interest. The last phrase of this sentence ("minimize the risk of matching error between the homologous regions of interest") is a well-known feature of pattern recognition and typically strived for by all matching systems.

It would have been obvious to one of ordinary skill in the art to utilize the teachings of Nields in a system to provide correlated, three-dimensional image data corresponding to a region of the body to enhance the medical diagnosis of a given location of interest.

As per claim 7, it recites generally the same limitations as claim 1 above and analogous remarks apply. Claim 7 is a broader version of claim 1 and therefore rejectable for the same reasons.

As per claims 6 and 15, which recite the matching includes a prior filtering of the stereotaxic images (OFFICIAL NOTICE). First, it would have been obvious to one of ordinary skill in the art to perform some initial filtering to remove any signal distortions caused by patient movement or noise introduced by system sensors. Second, the applicant admits this is well-known citing an article from 1988 on page 17, ll. 12-17 of his specification..

11. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nields as applied to claim 1 above, and further in view of Gerstenberger, US 5220441.

As per claim 2, Nields dos not teach the specifics of his correlation method. However, Gerstenberger does teach:

wherein the correlation values includes the selection of a certain number (tiepoints, col. 2, ll. 35-50) of correlation maxima or minima, the homologous region of interest being selected from those for which the associated correlation value is one of the correlation maxima or minimum (col.2, ll. 50-56).

It would have been obvious to one of ordinary skill in the art to utilize the correlation algorithms as taught by Gerstenberger in correlating the stereotaxic images of Nields to rapidly determine the degree of offset between two images thereby overcoming resolution and precision limitations.

As per claim 3, Gerstenberger teaches:

wherein the analysis of the correlation values obtained includes a determination of the dynamic range of the maxima or minima selected, and the comparison of the dynamic values obtained with a threshold (col. 3, ll. 3-8).

12. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nields as applied to claim 1 above, and further in view of Russ, The Image Processing Handbook, 2nd Edition, CRC Press, 1994.

As per claim 4, Nields does not specifically teach:

the correlation processing includes a normalized correlation processing. However, Russ teaches that normalized correlation is a basic form of correlation utilized in image processing (p. 342).

It would have been obvious to one of ordinary skill in the art to utilize the well-known features as taught by Russ in the correlation of images as taught by Nields in order to prevent erroneous results from spurious correlation values.

13. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nields as applied to claim 1 above, and further in view of Pratt, Digital Image Processing, Second Edition, Wiley & Sons, 1991.

As per claim 5, Nields does not specifically teach using normalized difference processing. However, Pratt teaches:

wherein the correlation processing includes a normalized difference processing (p. 669).

It would have been utilize the absolute difference error to as taught by Pratt in the correlation system of Nields in order to determine the proper misregistration offset which is normalized to take into account the different imaging systems, patient motion, etc. that may effect the alignment of the stereotaxic images.

14. Claims 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nields as applied to claims 1 and 7 above, and further in view of Kenet et al., (Kenet), US 5,836,872.

As per claim 8, Nields does not that the predetermined characteristics comprise shape contrast, or gradient characteristics. However, Kenet does teach such a limitation (col. 14, l.39).

It would have been obvious to one of ordinary skill in the art to utilize the body imaging and classification of body surface and subsurface features techniques as taught by Kenet in the imaging system of Nields to improve the accuracy of quantification and classification of anatomical and physiological features of the human retina during three-dimensional imaging.

As per claim 9, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (col. 14, ll. 52-61).

As per claim 10, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (col, 14, ll. 52-61).

As per claims 11 and 12, which depend upon claims 1 and 7 respectively, Kenet teaches:

wherein an epipolar zone containing at least the epipolar segment relating to the target pixel is determined in the second stereotaxic image and the pixels in the epipolar zone contain the selected pixels (col. 14, ll. 47-75).

As per claims 13 and 14, which depend upon claims 1 and 7 respectively, Kenet teaches:

wherein the selected pixels are chosen from the pixels in the second image which have a gray-scale level maxima or minima whose dynamic range is greater than a predetermined threshold (col. 14, ll. 40-43).

15. Claims 1 6 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb et al. (Robb), US 5568384, and further in view of Mick et al. (Mick), US 5261404.

As per claim 1 Robb teaches:

providing a set of digitized stereotaxic images having positions of homologous regions of interest corresponding to the element of interest and appearing in the set of stereotaxic images (volume images, col. 3, ll. 55-60);

selecting in a first stereotaxic image a first (base image) target region of interest having a target pixel (col. 3, l. 58);

matching the first region of interest with a second region of interest (object contour) homologous to the first region of interest and appearing in the second region of interest (col. 3, l. 61-col. 4, l. 10);

matching a generated target window of chosen dimensional characteristics and containing the target region of interest around the selected target pixels (col. 3, l. 55-col. 4, l. 5);

determining a set pixels (limited number of points, col. 4, ll. 5-9) in the second image according to a predetermined selection criterion so as to generate a second window having the same dimensional characteristics as the target window around each selected pixel;

Robb does not however teach the use of correlation. Mick doe teach:

processing a correlation between the gray-scale levels of the pixels in each second window to obtain a correlation for each second window (col 6, ll. 30-40);

using the correlation values to identify the region of interest homologous to the target region of interest (col. 6, ll. 50-65, col. 8, ll. 6-15) and thereby minimize the risk of matching error between the homologous regions of interest. The last phrase of this sentence ("minimize the risk of matching error between the homologous regions of interest") is a well-known feature of pattern recognition and typically strived for by all matching systems.

It would have been obvious to one of ordinary skill in the art to utilize the teachings of Mick to provide the image processing techniques using correlation to identify a target region in a first and second image to matched by Robb to allow a physician the opportunity to traverse the anatomy prior to penetrating it with instruments to establish the optimum route through the anatomy.

As per claim 7, it recites generally the same limitations as claim 1 above and analogous remarks apply. Claim 7 is a broader version of claim 1 and therefore rejectable for the same reasons.

As per claims 6 and 15, which recite the matching includes a prior filtering of the stereotaxic images (OFFICIAL NOTICE). First, it would have been obvious to one of ordinary skill in the art to perform some initial filtering to remove any signal distortions caused by patient movement or noise introduced by system sensors. Second, the applicant admits this is well-known citing an article from 1988 on page 17, ll. 12-17 of his specification.

16. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and Mick as applied to claim 1 above, and further in view of Gerstenberger, US 5220441.

As per claim 2, Mick does not teach the specifics of his correlation method. However, Gerstenberger does teach:

wherein the correlation values includes the selection of a certain number (tiepoints, col. 2, ll. 35-50) of correlation maxima or minima, the homologous region of interest being selected from those for which the associated correlation value is one of the correlation maxima or minimum (col.2, ll. 50-56).

It would have been obvious to one of ordinary skill in the art to utilize the correlation algorithms as taught by Gerstenberger in correlating the stereotaxic images of Robb and Mick to rapidly determine the degree of offset between two images thereby overcoming resolution and precision limitations.

As per claim 3, Gerstenberger teaches:

wherein the analysis of the correlation values obtained includes a determination of the dynamic range of the maxima or minima selected, and the comparison of the dynamic values obtained with a threshold (col. 3, ll. 3-8).

17. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and Mick as applied to claim 1 above, and further in view of Russ, The Image Processing Handbook, 2nd Edition, CRC Press, 1994.

As per claim 4, Robb and Mick do not specifically teach:

the correlation processing includes a normalized correlation processing. However, Russ teaches that normalized correlation is a basic form of correlation utilized in image processing (p. 342).

It would have been obvious to one of ordinary skill in the art to utilize the well-known features as taught by Russ in the correlation of images as taught by Robb and Mick in order to prevent erroneous results from spurious correlation values.

18. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and Mick as applied to claim 1 above, and further in view of Pratt, Digital Image Processing, Second Edition, Wiley & Sons, 1991.

As per claim 5, Robb and Mick do not specifically teach using normalized difference processing. However, Pratt teaches:

wherein the correlation processing includes a normalized difference processing (p. 669).

It would have been utilize the absolute difference error to as taught by Pratt in the correlation system of Robb and Mick in order to determine the proper misregistration offset which is normalized to take into account the different imaging systems, patient motion, etc. that may effect the alignment of the stereotaxic images.

19. Claims 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb and Mick as applied to claims 1 and 7 above, and further in view of Kenet et al., (Kenet), US 5,836,872.

Robb & Mick teach

As per claim 8, Nields does not that the predetermined characteristics comprise shape contrast, or gradient characteristics. However, Kenet does teach such a limitation (col. 14, l.39).

It would have been obvious to one of ordinary skill in the art to utilize the body imaging and classification of body surface and subsurface features techniques as taught by Kenet in the imaging system of Robb and Mick to improve the accuracy of quantification and classification of anatomical and physiological features of the human retina during three-dimensional imaging.

As per claim 9, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (col. 14, ll. 52-61).

As per claim 10, Kenet teaches:

wherein the comparison processing includes a distance minimization processing between the two sets of numerical values (col, 14, ll. 52-61).

As per claims 11 and 12, which depend upon claims 1 and 7 respectively, Kenet teaches:

wherein an epipolar zone containing at least the epipolar segment relating to the target pixel is determined in the second stereotaxic image and the pixels in the epipolar zone contain the selected pixels (col. 14, ll. 47-75).

As per claims 13 and 14, which depend upon claims 1 and 7 respectively, Kenet teaches:

wherein the selected pixels are chosen from the pixels in the second image which have a gray-scale level maxima or minima whose dynamic range is greater than a predetermined threshold (col. 14, ll. 40-43).

20. Claims 16-19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb.

As per claim 16, Robb teaches:

providing a set of digitized stereotaxic (volume images, col. 3, ll. 55-60) images having positions of homologous regions of interest corresponding to the element of interest and appearing in the set of stereotaxic images (col. 1, ll. 30-31, col. 2, ll. 17-23);

selecting in a first stereotaxic image of a first target region of interest (base image, col. 3, l. 58);

selecting a second stereotaxic image on the basis of the a first automatic matching of at least a second region of interest (match image, col. 3, l. 59, and col. 4, ll. 15-60)).

determining the spatial position of a candidate pixel of a candidate element of interest corresponding to the two regions of interest (col. 3, l. 60-col. 4, l. 9);

determining in a third stereotaxic image of a projected pixel corresponding to the projection into the third stereotaxic image of the candidate pixel. Robb does not specifically teach such a feature, But he does provide suggestion that his system is capable of performing such a function. In col. 1, ll. 29-31, Robb states that one or more images are transformed to bring them into spatial registration with another. This statements indicates that Robb's method is a sequential method operating on two image surfaces at a time until all of the image surfaces desired to be registered are matched. Also in col. 2 , ll. 49-55, Robb states that the geometric transformation accommodates images of different position, orientation, and size, thereby not limiting himself to only two image surfaces. Further in line 54 of col.2, Robb teaches that his system will adjust the image surfaces to the best fit that minimizes the cost function.

If the process of Robb is sequential then the following step would also be taught as the first automatic matching. Robb teaches providing a second automatic matching between the target region of interest and a vicinity of the projected pixel (col. 3, l. 59, and col. 4, ll. 15-60).

defining a projected region of interest so as to minimize the risk of matching errors between the homologous regions of interest (col. 4, ll. 5-10).

As per claim 17, Robb teaches:

wherein the selecting in the second stereotaxic image is on the basis of the first automatic matching a set of second regions which may be homologous to the target region;

determining the spatial position of each candidate pixel corresponding to each pair of regions of interest (match surface points, col 4, l. 57) which is formed by the target region and one of the second regions;

determining the spatial position in the third image óf each corresponding projected pixel; and performing the second automatic matching between the target region and vicinity of each projected pixel (col.4, l. 16-col. 5, l. 45).

As asserted above in the rejection of claim 16, the system of Robb would use two images and then integrate the solution of the first matching into the determination of an optimal minimized cost function utilizing the next image to be registered.

As per claim 18, Rob teaches:

wherein the set of second regions obtained is ordered in the decreasing order of their probability of being in the region homologous to the target region (col. 6, ll. 53-60). One of ordinary skill in the art would have been able to determine a match probability from the resulting local minimum.

wherein the set of projected regions obtained is ordered in the decreasing order (This is a design choice.) of their probability of being the region homologous to the target region (col. 6, ll. 60-63); and

wherein the region homologous to the target region is selected as being the one whose product of the respective ranks of the two orderings is a minimum (col. 6, l. 62).

As per claim 21, Robb teaches:

wherein the second automatic matching includes a comparison matching between the target region of interest and each projected region of interest (col. 4, ll. 16-20).

21. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Robb as applied to claim 16 above, and further in view of Nields.

As per claim 19, Robb does not teach a first matching being is a correlation processing matching, however, Nields teaches:

wherein the first automatic matching is a correlation processing matching (col. 8, ll. 13-38).

It would have been obvious to use the image contour features of Robb in conjunction with the correlation features of Nields to provide a system using spatially correlated information that enhances medical diagnosis of a given location of interest in the body.

As per claim 20, Nields teaches:

wherein the second automatic matching includes a correlation processing matching between the vicinity of each projected pixel and a target window containing the target region of interest (col 8, ll. 13-38).

Conclusion

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following U.S. patents refer to imaging of the human body utilizing correlation and other features: Eidelberg et al., 5632276, Toker et al, 5142557, Lewis et al., 5394875,

Dumoulin et al., 5526812, Hochman et al., 5699798 and 5845639, Yeung, 5588033, Qian, 5381791, Bishop et al, 4589140, Smith et al., 5515853, Hasewaga et al., 5376795.

23. Any inquiry to this communication should be directed to the Examiner, Martin Miller, whose telephone number is (703) 306-9134. If you are unable to reach the Examiner, his supervisor's name is Amelia Au, whose telephone number is (703) 308-6604. The Art Unit Facsimile machine number is (703) 306-5406.

Amelia Au
Supervisory Patent Examiner
Technology Center 2700